



DEPARTMENT OF THE AIR FORCE
59TH MEDICAL WING (AETC)
JOINT BASE SAN ANTONIO - LACKLAND TEXAS

17 FEB 2017

MEMORANDUM FOR SGDTG

ATTN: MAJ STEPHEN ARNASON

FROM: 59 MDW/SGVU

SUBJECT: Professional Presentation Approval

1. Your paper, entitled **Fracture Resistance of Bonded CAD/CAM Restorations with Undermined Tooth Structure** presented at/published to **International Association of Dental Research, San Francisco, CA, 22-26 March 2017** in accordance with MDWI 41-108, has been approved and assigned local file #**17081**.
2. Pertinent biographic information (name of author(s), title, etc.) has been entered into our computer file. Please advise us (by phone or mail) that your presentation was given. At that time, we will need the date (month, day and year) along with the location of your presentation. It is important to update this information so that we can provide quality support for you, your department, and the Medical Center commander. This information is used to document the scholarly activities of our professional staff and students, which is an essential component of Wilford Hall Ambulatory Surgical Center (WHASC) internship and residency programs.
3. Please know that if you are a Graduate Health Sciences Education student and your department has told you they cannot fund your publication, the 59th Clinical Research Division may pay for your basic journal publishing charges (to include costs for tables and black and white photos). We cannot pay for reprints. If you are 59 MDW staff member, we can forward your request for funds to the designated wing POC.
4. Congratulations, and thank you for your efforts and time. Your contributions are vital to the medical mission. We look forward to assisting you in your future publication/presentation efforts.

Linda Steel-Goodwin

LINDA STEEL-GOODWIN, Col, USAF, BSC
Director, Clinical Investigations & Research Support

PROCESSING OF PROFESSIONAL MEDICAL RESEARCH/TECHNICAL PUBLICATIONS/PRESENTATIONS

INSTRUCTIONS

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 - b. In Section 2, there may be funding available for journal costs, if your department is not paying for figures, tables or photographs for your publication. Please state "YES" or "NO" in Section 2 of the form, if you need publication funding support.
2. Print your name, rank/grade, sign and date the form in the author's signature block or use an electronic signature.
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6. TITLE OF MATERIAL TO BE PUBLISHED OR PRESENTED: Fracture Resistance of Bonded CAD/CAM Restorations with Undermined Tooth Structure			
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Fracture Resistance of Bonded CAD/CAM Restorations with Undermined Tooth Structure

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ABSTRACT #



INTRODUCTION

Colloquial conversations have been reported, in both educational and private practice settings, that bonded CAD/CAM restorations reinforce undermined cusps.

OBJECTIVE

The purpose of this study was to evaluate the fracture resistance of teeth with and without undermined tooth structure bonded with lithium-disilicate and resin-nano ceramic restorations.

MATERIALS and METHODS

Seventy extracted maxillary molars of similar size were used in this study. Thirty teeth were prepared with 3.0mm of buccal and lingual cusps remaining with undermined enamel (extended preparations) and thirty teeth were prepared with 4.5mm of buccal and lingual cusps remaining (standard preparations). After scanning and milling (CEREC Omnicam, MCXL, Sirona), 10 teeth per preparation type were restored with lithium disilicate (e.max CAD, Ivoclar Vivadent), 10 teeth per preparation type were restored with resin-nano ceramic (Lava Ultimate, 3M/ESPE), and 10 teeth per preparation type were unrestored (negative control). An additional ten teeth were not prepared or restored (positive control). All seventy teeth were thermocycled (2000 cycles, 5° C - 55° C, Sabri Dental Enterprises) and cyclically loaded (150N, 100,000 cycles, 1Hz, Sabri Dental Enterprises). Specimens were fractured in a material testing device (Instron) using a 6mm-diameter cylindrical piston resting on the buccal and lingual inclines. Data were analyzed with a two-way ANOVA/Tukey's and Dunnett's (alpha=0.05). Fracture modes were categorized as Type 1: isolated fracture of restoration, Type 2: isolated fracture of a small portion of the tooth, Type 3: restoration fracture involving 1 cusp, Type 4: fracture involving more than half of the tooth, without periodontal involvement and Type 5: fracture with periodontal involvement.



Standard Preparation



Extended Preparation

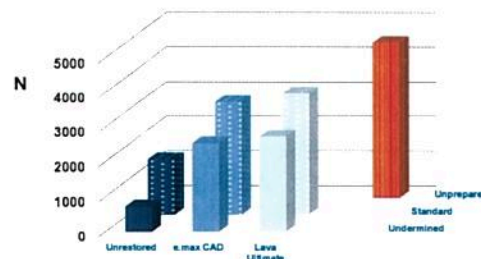
RESULTS

The extended preparations with undermined cusps resulted in significantly less fracture strength than the standard preparations ($p<0.001$). The unrestored teeth had significantly less fracture strength than the restored teeth ($p<0.001$), which were not significantly different from each other ($p=0.623$). All groups had significantly lower fracture strength than the unprepared group ($p<0.007$). Fracture modes are displayed in the graph below.

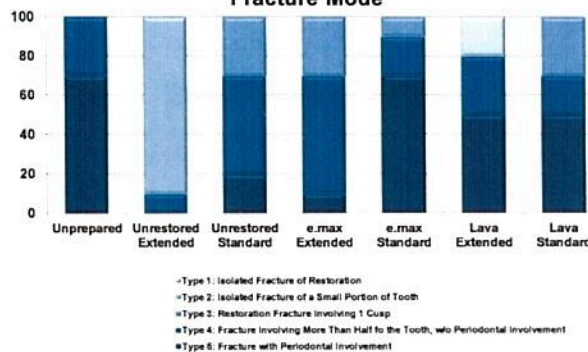
	Fracture Strength (Newtons, st dev)		Mean
	Preparation Type		
	Extended (Undermined)	Standard	
e.max CAD	2547.9 (468.7)	3248.2 (781.2)	2936.9 (736.0) A
Lava Ultimate	2736.9 (524.6)	3504.9 (916.4)	3120.9 (826.7) A
Unrestored	731.0 (290.2)	1586.6 (436.8)	1158.8 (568.2) B
Mean	1966.5 (1030.6) b	2799.9 (1121.2) a	
	Unprepared 4475.3 (797.4)		

Groups with the same upper case letter per column or lower case letter per row are not significantly different ($P>0.05$)

Fracture Strength



Fracture Mode



CONCLUSIONS

Although bonded CAD/CAM restorations reinforced tooth structure, fracture strength was significantly lower with teeth with undermined cusps. Type of material did not significantly affect fracture strength. Of the restored teeth, the extended preparations restored with e.max CAD had the least catastrophic fractures.

**59th Medical Wing (59th MDW)
Institutional Review Board (IRB)**
59th Clinical Research Division/SGVUS/(210) 292-7143
2200 Bergquist Dr, Bldg 4430, Lackland AFB, TX 78236-5300

27 Nov 15

FINAL DETERMINATION – NON-HUMAN RESEARCH

Determination Date: 25 Nov 2015

Project Lead: Capt Stephen Arnason/SGDTG

Reference Number: FWH20160023N

Project Title: Stabilization Effects of Recent CAD/CAM Restorations in Extended MOD Preparations as a Function of Tooth Preparation Design and Undermined Enamel

You may begin your project, as you would any other clinical or operational activity, with the approval and sponsorship of your leadership.

Your project was determined on 25 Nov 2015 to be considered **not human research** as defined by DoD regulation **32 CFR 219 and FDA regulation 21 CFR 56**. Continued IRB oversight for this activity is not required. The proposed project does not include non-routine intervention or interaction with a living individual for the primary purpose of obtaining data regarding the effect of the intervention or interaction, nor do the researchers obtain private, identifiable information about living individuals.

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In accord with DoDI 6000.08 any intramural funding of this study as research or as a clinical investigation may continue to be received or sought regardless of this IRB determination.

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